

Applicant : Andreas Hilliger et al.  
Serial No.: 10/625,493  
Filed : July 22, 2003

Attorney's Docket No.: 14530-020001

Amendment to the Claims:

This listing of claims replaces all prior versions, and listings, of claims in the application:

1. (Currently Amended) A method of forming a contact to an underlayer or region of a device comprising ~~the steps of:~~  
forming a contact hole through a portion of the device including through a first barrier layer, the contact hole having sides which extend above and below the first barrier layer and having a bottom surface;  
forming a contact hole barrier layer of a barrier material in the contact hole, the contact hole barrier layer being continuous between the sides and bottom surface of the contact hole;  
etching the contact hole barrier layer on the bottom surface of the contact hole;  
depositing a liner material in the contact hole to form a contact liner to promote subsequent filling of the contact hole;  
and  
filling the contact hole with a conductive material.

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2. (Currently Amended) A method according to claim 1 ~~in which the contact hole is formed extending through a portion of the device including a first barrier layer, the method including further comprising a wet etching the contact hole step, prior to forming the contact hole barrier layer, the contact hole barrier layer being formed after the wet etching step and filling voids in the first barrier layer caused by the wet etching step.~~

3. (Original) A method according to claim 1 including a wet etching step, the contact hole barrier layer being formed before the wet etching step.

4. (Currently Amended) A method according to claim 2 3 in which, following the wet etching step, the contact hole barrier layer is thickened by application of a second contact hole barrier layer.

5. (Currently Amended) A method according to claim 1, in which the barrier material of the contact hole barrier layer is  $\text{Al}_2\text{O}_3$  or  $\text{TiO}_2$ .

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6. (Currently Amended) A method according to claim 1, in which the barrier material of the contact hole barrier layer is deposited using an atomic layer deposition (ALD) method.

7. (Original) A method according to claim 1, in which the device is a semiconductor device.

8. (Original) A method according to claim 1, in which the device is a passive device.

9. (Original) A method according to claim 1, in which the device is a capacitor.

10. (Original) A method according to claim 9, in which the device is an FeRAM.

11. (Withdrawn) A device including a contact to an underlayer of the device formed by forming a contact hole, forming a contact hole barrier layer of a barrier material in the contact hole, etching the contact hole barrier layer on the bottom surface of the contact hole, depositing a liner material in the contact hole and filling the contact hole with a conductive material.

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12. (Withdrawn) A device according to claim 11, in which the barrier material is  $\text{Al}_2\text{O}_3$  or  $\text{TiO}_2$ .

13. (Withdrawn) A semiconductor device including a contact to an underlayer of the device formed by forming a contact hole, forming a contact hole barrier layer of a barrier material in the contact hole, etching the contact hole barrier layer on the bottom surface of the contact hole, depositing a liner material in the contact hole, and filling the contact hole with a conductive material.

14. (Withdrawn) A semiconductor device according to claim 13, in which the barrier material is  $\text{Al}_2\text{O}_3$  or  $\text{TiO}_2$ .

15. (Withdrawn) A capacitor including a contact to an underlayer of the device formed by forming a contact hole, forming a contact hole barrier layer of a barrier material in the contact hole, etching the contact hole barrier layer on the bottom surface of the contact hole, depositing a liner material in the contact hole and filling the contact hole with a conductive material.

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16. (Withdrawn) A capacitor according to claim 15, in which the barrier material is  $\text{Al}_2\text{O}_3$  or  $\text{TiO}_2$ .

17. (Withdrawn) An FeRAM device including a contact to an underlayer of the device formed by forming a contact hole, forming a contact hole barrier layer of a barrier material in the contact hole, etching the contact hole barrier layer on the bottom surface of the contact hole, depositing a liner material in the contact hole and filling the contact hole with a conductive material.

18. (Withdrawn) An FeRAM device according to claim 17, in which the barrier material is  $\text{Al}_2\text{O}_3$  or  $\text{TiO}_2$ .

19. (New) A method of forming a contact to an underlayer or region of a device comprising:

forming a contact hole through a portion of the device including through a first barrier layer, the contact hole having sides which extend above and below the first barrier layer and having a bottom surface;

wet etching the contact hole;

forming a contact hole barrier layer of a barrier material in the contact hole, after wet etching the contact hole, thereby

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filling voids in the first barrier layer caused by the wet etching;

etching the contact hole barrier layer on the bottom surface of the contact hole;

depositing a liner material in the contact hole to form a contact liner to promote subsequent filling of the contact hole; and

filling the contact hole with a conductive material.

20. (New) A method of forming a contact to an underlayer or region of a device comprising:

forming a contact hole;

forming a contact hole barrier layer of a barrier material in the contact hole;

wet etching the contact hole after forming the contact hole barrier layer;

thickening the contact hole barrier layer by application of a second contact hole barrier layer;

etching the contact hole barrier layer on the bottom surface of the contact hole;

depositing a liner material in the contact hole to form a contact liner to promote subsequent filling of the contact hole; and

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filling the contact hole with a conductive material.